CURRICULUM PROPOSAL COVER SHEET
University-Wide Undergraduate Curriculum Committee

LSC Use Only
Number _LS 48_
Action _A_
Date _2-2-89_

UWUCC Use Only
Number _____
Action _____
Date _____

I. TITLE/AUTHOR OF CHANGE
COURSE/PROGRAM TITLE _MA 110 - Elementary Functions_
DEPARTMENT _Mathematics_
CONTACT PERSON _John Broughton_

II. THIS COURSE IS BEING PROPOSED FOR:
_____ Course Approval Only
_____ Course Approval and Liberal Studies Approval
__✓__ Liberal Studies Approval only (course previously has been approved by the University Senate)

III. APPROVALS

Elwood Spearman
Department Curriculum Committee

John Broughton
Department Chairperson

_____
College Curriculum Committee

_____
College Dean*

_____
Director of Liberal Studies
(where applicable)

_____
Provost
(where applicable)

*College Dean must consult with Provost before approving curriculum changes. Approval by College Dean indicates that the proposed change is consistent with long range planning documents, that all requests for resources made as part of the proposal can be met, and that the proposal has the support of the university administration.

IV. TIMETABLE

Date Submitted
to LSC _____
to UWUCC _____

Semester/Year to be
implemented _____

Date to be published
in Catalog _____

Revised 5/88

[Attach remaining parts of proposal to this form.]

INDIANA UNIVERSITY OF PENNSYLVANIA
MATHEMATICS DEPARTMENT

COURSE NUMBER: MA 110

COURSE TITLE: Elementary Functions

CREDITS: 3 Semester hours

CATALOG DESCRIPTION:
For students not prepared to begin the study of calculus;
topics include polynomial, exponential, logarithmic, and
trigonometric functions.

PRESENT TEXT: Algebra and Trigonometry, A Functions Approach
(4th Edition)
by Keedy and Bittinger

COURSE OUTLINE:

I.   Basic Concepts of Algebra
        A. Factoring
        B. Fractional Expressions
        C. Radical Notation
        D. Rational Exponents

II.   Equations, Inequalities, and Problem Solving
        A. Solving Equations and Inequalities
        B. Fractional Equations
        C. Formulas and Problem Solving
        D. Quadratic Equations
        E. Radical Equations

III.   Relations, Functions, and Transformations
        A. Relations and Ordered Pairs
        B. Graphs of Equations
        C. Functions
        D. Symmetry
        E. Transformations
        F. Some Special Classes of Functions

IV.   Linear and Quadratic Functions and Inequalities
        A. Lines and Linear Functions
        B. Quadratic Functions
        C. Mathematical Models
        D. Sets, Sentences, and Inequalities
        E. Equations and Inequalities with Absolute Value
        F. Quadratic and Rational Inequalities

V.   Polynomials and Rational Functions
        A. Polynomials and Polymonial Functions

B. Theorems Concerning Roots of Polynomials
C. Graphs of Polynomial Functions
D. Rational Functions
E. Partial Fractions

VI. Exponential and Logarithmic Functions
A. Inverses of Relations
B. Exponential and Logarithmic Functions
C. Properties of Logarithmic Functions
D. Exponential and Logarithmic Equations

VII. Trigonometric or Circular Functions
A. The Unit Circle
B. The Sine and Cosine Functions
C. The Other Basic Circular Functions
D. The Functions Interrelated
E. Graphs

TIME SCHEDULE:

Chapter	Section	Time
I	4, 5, 7, 8, 9	4 hours
II	1 - 5, 6, 7	6 hours
III	1, 2, 3, 4, 5, 6	5 hours
IV	1 - 1	6 hours
XII	1, 2, 3, 4, 5, 6, 7, 8	8 hours
VII	1, 2, 3, 5	4 hours
VIII	1 - 5	5 hour

SUGGESTED PROBLEMS LIST:

Assign all odd or all even from each section covered. You may want to exclude those exercises which require a calculator. They are clearly marked in the text.

Totals: Lecture: 38 hours
Review: 1 hour
Exams: 3 hours

LIBERAL STUDIES COURSE APPROVAL FORM

About this form: Use this form only if you wish to have a course included for Liberal Studies credit. The form is intended to assist you in developing your course to meet the university's Criteria for Liberal Studies, and to arrange your proposal in a standard order for consideration by the LSC and the UWUCC. If you have questions, contact the Liberal Studies Office, 353 Sutton Hall; telephone, 357-5715.

Do not use this form for technical, professional, or pre-professional courses or for remedial courses, none of which is eligible for Liberal Studies. **Do not** use this form for sections of the synthesis course or for writing-intensive sections; different forms will be available for those.

PART I. BASIC INFORMATION

A. For which category(ies) are you proposing the course? Check all that apply.

LEARNING SKILLS

    _____ First English Composition Course
    _____ Second English Composition Course
    _✓_ Mathematics

KNOWLEDGE AREAS

    _____ Humanities: History
    _____ Humanities: Philosophy/Religious Studies
    _____ Humanities: Literature
    _____ Fine Arts
    _____ Natural Sciences: Laboratory Course
    _✓_ Natural Sciences: Non-laboratory Course
    _____ Social Sciences
    _____ Health and Wellness
    _____ Non-Western Cultures
    _____ Liberal Studies Elective

B. Are you requesting regular or provisional approval for this course?

    _✓_ **Regular**   _____ **Provisional** (limitations apply, see instructions)

    New Course

C. During the transition from General Education to Liberal Studies, should this course be listed as an approved substitute for a current General Education course, thus allowing it to meet any remaining General Education needs? _✓_ yes _____ no

    If so, which General Education course(s)? _MA-110_

PART II. WHICH LIBERAL STUDIES GOALS WILL YOUR COURSE MEET? Check all that apply and attach an explanation.

All Liberal Studies courses must contribute to at least one of these goals; most will meet more than one. As you check them off, please indicate whether you consider them to be primary or secondary goals of the course. [For example, a history course might assume "historical consciousness" and "acquiring a body of knowledge" as its primary goals, but it might also enhance inquiry skills or literacy or library skills.] Keep in mind that no single course is expected to shoulder all by itself the responsibility for meeting these goals; our work is supported and enhanced by that of our colleagues teaching other courses.

	Primary	Secondary
A. Intellectual Skills and Modes of Thinking:		
1. Inquiry, abstract logical thinking, critical analysis, synthesis, decision making, and other aspects of the critical process.	✓	
2. Literacy--writing, reading, speaking, listening		✓
3. Understanding numerical data	✓	
4. Historical consciousness		✓
5. Scientific inquiry		✓
6. Values (ethical mode of thinking or application of ethical perception)		✓
7. Aesthetic mode of thinking	✓	
B. Acquiring a Body of Knowledge or Understanding Essential to an Educated Person	✓	
C. Understanding the Physical Nature of Human Beings		
D. Certain Collateral Skills:		
1. Use of the library		✓
2. Use of computing technology		✓

ADDENDUM TO LIBERAL STUDIES PROPOSALS: PART II

The Liberal Studies Goals met by the Course MA 110:

A. Intellectual Skills and Modes of Thinking:

1. Inquiry, abstract logical thinking, critical analysis,
    synthesis, decision making, and other aspects of the
    critical process is a primary goal of the course. It
    is apparent that the study of Mathematics requires that the
    student become involved in all of these categories. Problem
    solving requires the student to collect data, to clearly state
    the problem to be solved, to determine the best method to use
    that will produce a solution, to analyze and to interpret the
    outcome, and then to mke a judgment about the validity of the
    work.

2. Literacy-writing, reading, speaking, listening, is a secondary
    goal of this course. All of these areas can be applied and
    improved during a course of study in mathematics. Reading
    skills are absolutely necessary for a clear understanding of
    the material; the writing of solutions to mathematical prob-
    lems requires clarity of mind and organization of thought;
    the requirement of discussing mathematics in the classroom
    shows the student the importance of clear patterns of thinking
    and of the expression of those thoughts orally; and listening
    skills are very important in the understanding of mathematics.
    These skills can be improved through the writing of tests and of
    assigned papers, through the oral response to classroom
    questions, and through the reading of assignments.

3. Understanding numerical data is a primary goal of this course.
    No data is meaningful without interpretation and the study of
    mathematics attempts to train the student in the methods and
    skills needed to interpret data correctly.

4. Historical consciousness is a secondary goal. Students should
    have some awareness of the historical significance of the
    role of mathematics in the development of western and other
    civilizations, and of its meaningful place in the application
    and utilization of modern technology.

5. Scientific inquiry is a secondary goal. Students should be made
    aware of the importance of mathematical logic and the role it
    plays in scientific inquiry, problem solving techniques, and
    decision making processes. Students should understand that
    mathematics is the language of science.

6. Aesthetic mode of thinking is a secondary goal. Mathematics to
    mathematicians and other users is a beautiful art form for
    communication and discovery. An effort should be made to develop
    in the student a sense of this beauty and an awareness of its
    power and utility.

B. Acquiring a Body of Knowledge or Understanding Essential to an
    Educated Person:
                        Secondary Goal

    - Although specific mastery of mathematics is not required of all

students, it is important that students taking mathematics in any form develop a sense of the importance of mathematics to society. In addition, the course of study should develop in the student a feeling of confidence in their own ability to use mathematical skills to generate improvement in the areas of problem solving, decision making, and deductive reasoning.

D.   Certain Collateral Skills:

2.   Use of computing technology is a secondary goal. Students need to be aware of the technology available in computing whether that technology be computers or calculators. In particular, calculators can be used in this course to increase the range and difficulty of problems that can be solved by students.

PART III. DOES YOUR COURSE MEET THE GENERAL CRITERIA FOR LIBERAL STUDIES?   Please attach answers to these questions.

A.   If this is a multiple-section, multiple-instructor course, there should be a basic equivalency (though not necessarily uniformity) among the sections in such things as objectives, content, assignments, and evaluation. Note: this should not be interpreted to mean that all professors must make the same assignments or teach the same way; departments are encouraged to develop their courses to allow the flexibility which contributes to imaginative, committed teaching and capitalizes on the streangths of individual faculty.

What are the strategies that your department will use to assure that basic equivalency exists?   Examples might be the establishment of departmental guidelines, assignment of repsonsibility to a coordinating committee, exchange and discussion of individual instructor syllabi, periodic meetings among instructors, etc.

B.   Liberal Studies courses must include the perspectives and contributions of ethnic and racial minorities and of women wherever appropriate to the subject matter. If your attached syllabus does not make explicit that the course meets this criterion, please append an explanation of how it will.

C.   Liberal Studies courses must require the reading and use by students of at least one, but preferably more, substantial works of fiction or nonfiction (as distinguished from textbooks, anthologies, workbooks, or manuals). Your attached syllabus must make explicit that the course meets this criterion.

[The only exception is for courses whose primary purpose is the development of higher level quantitative skills: such courses are encouraged to include such reading, but are not expected to do so at the expense of other course objectives. If you are exercising this exception, please justify here.]

D.   If this is an introductory course intended for a general student audience, it should be designed to reflect the reality that it may well be the only formal college instruction these students will have in that discipline, instead of being designed as the first course in a major sequence. That is, it should introduce the discipline to students rather than introduce students into the discipline. If this is such an introductory course, how is it different from what is provided for beginning majors?

ADDENDUM TO LIBERAL STUDIES PROPOSALS: PART III

B.   Whenever appropriate, information will be introduced into the classroom discussion which will reflect the contributions made to mathematics by women and by minorities. Particular attention will be given to the following areas as they relate to this topic:

1.   The classroom discussion will be sensitive to gender balancing with respect to language.

2.   Quizzes, tests, examinations, and any other written information distributed to the students will be sensitive to gender balancing, especially in problem construction, and to minorities whenever possible.

3.   Specific names and contributions made by women and other members of minority groups will be discussed in the classroom when the discussion of such is germain to the material being studied. It should be noted though that mathematics has been the domain of the male throughout history and only in recent time has there been numbers of women involved. Even today, there are too few women in the field of mathematics.

E. The Liberal Studies Criteria indicate six ways in which all courses should
    contribute to students' abilities. To which of the six will your course
    contribute? Check all that apply and attach an explanation.

   _____ 1. Confront the major ethical issues which pertain to the subject matter;
            realize that although "suspended judgment" is a necessity of
            intellectual inquiry, one cannot live forever in suspension; and make
            ethical choices and take responsibility for them.

   _____ 2. Define and analyze problems, frame questions, evaluate available
            solutions, and make choices

   _____ 3. Communicate knowledge and exchange ideas by various forms of
            expression, in most cases writing and speaking.

   _____ 4. Recognize creativity and engage in creative thinking.

   _____ 5. Continue learning even after the completion of their formal
            education.

   _____ 6. Recognize relationships between what is being studied and current
            issues, thoughts, institutions, and/or events.

PART IV. DOES YOUR COURSE MEET THE CRITERIA FOR THE CURRICULUM CATEGORY IN WHICH IT IS TO BE LISTED?

Each curriculum category has its own set of specific criteria in addition to those
generally applicable. The LSC provides copies of these criteria arranged in a
convenient check-list format which you can mark off appropriately and include
with your proposal. The attached syllabus should indicate how your course
meets each criterion you check. If it does not do so explicitly, please
attach an explanation.

PART III (MA 110)

A. There will be a common syllabi of topics that should be covered by each of the individual instructors teaching this course. Such common syllabi should include but not be limited to topics which introduce the student to deductive reasoning, develop in the student problem solving skills, and enable the student not only to understand the underlying principles of formulae but also to have the ability to use and interpret numerical data.

B. Whenever appropriate, information will be introduced into the classroom discussion which will reflect the contributions made to mathematics by women and by racial minorities.

C. Two readings will be assigned during the course. The student is required to respond to each assignment in writing. The purpose of the writing is for each student to formulate and express his/her interpretation and impression of the reading. A reading list for this course is as follows:
        (1) "World of Mathematics" by Newman.
        (2) "Mathematics in Western Culture" by Kline.
        (3) "Women in Mathematics" vy Osen.
        (4) "The Mathematical Experience" by Davis and Hersh.
        (5) "Mathematics: An Introduction to Its Spirit and Use"
            from the "Scientific American".

D. The thrust of MA 110 is not to be remedial in nature but rather to develop in the student an awareness of and an appreciation for the power and usefulness of mathematics and its important role in a technological society, and in particular to prepare the student for the further study of calculus. A partial list of topics that would be appropriate for this course would include basic concepts of algebra; equations, inequalities, and problem solving; relations, functions, and transformations; linear and quadratic functions and inequalities; polynomials and rational functions; exponential and logarithmic functions; and trigonometric or circular functions. These topics would provide the course with a suitable mathematical strata that would improve the mathematical maturity of students to the point where they would be prepared to enroll in calculus. Additionally, this course would enable the student to develop confidence in handling numerical problems, would present the student with an opportunity to develop an appreciation for mathematics, and would allow the introduction to students of hand held calculators and possibly computers.

E. #2.- The very nature of mathematical study requires that problems be clearly analyzed and defined, that solutions be generated for such problems, and that an interpretation be assigned to each possible solution in order that a correct choice may be made.
    #4.- Mathematics is exactly the art of creative thinking. One moves from the collection of data to the definition of the problem to the abstract generalization in which a solution or solutions are constructed to the interpretation of the solution or solutions

to the application of the solution(s). This process requires one
to recognize creativity and to engage in creative thinking.
#5.- One is constantly exposed to information which needs the
principles of mathematics for proper interpretation. Skills
mastered in this course can last one a life time.

ADDENDUM TO THE SYLLABUS FOR THE COURSE MA 110

Course Objectives for the Course MA 110:

I.   General Objectives:

  A.   Students will develop an appreciation for the nature, the
       breadth, and the power of mathematics and for its role in
       a technological society.
  B.   Students will develop elementary skills in the use and
       application of algebra.
  C.   Students will learn to communicate in the language of math-
       ematics. This learning will involve reading, writing,
       listening, and speaking.
  D.   Students will be exposed to basic problem solving skills
       founded on the principles of mathematics and will learn
       to apply these skills to situations found in the study
       of calculus.
  E.   Students will become confident in their mathematical
       awareness and will become adept at the application
       of basic numerical skills to the study of calculus.
  F.   Students will become aware of the meaningful role played
       in our society by calculators and computers.
  G.   Students will use the skills learned in this course to
       successfully study the topic of calculus.

II. Some Specific Course Objectives:

  A.   Students will be able to understand the important role that
       pattern recognition plays in the study of mathematics.
  B.   Students will study the basic concepts of algebra.
  C.   Students will apply the concepts of algebra to the study
       of fundamental equations and inequalities.
  D.   Students will use the study of algebra and inequalities to
       explore the concepts of relation, function, graphs of
       functions, symmetry of functions, transformations, and
       special classes of functions.
  E.   Students will develop the principles needed for a clear
       understanding of linear functions, linear inequalities,
       quadratic functions, and quadratic inequalities.
  F.   Students will study the properties of polynomials and their
       graphs.
  G.   Students will study the logarithmic and exponential functions,
       their inverse relationship, and their graphs.
  H.   Students will study the trigonometric functions and their
       properties and graphs.
  I.   All of these topics will prepare the student for a successful
       study of calculus.

CHECK LIST -- MATHEMATICS
(Learning Skills Area)

Mathematics Criteria which the Course must meet:

__✓__ Introduce students to deductive reasoning

__✓__ Develop in the student problem solving techniques appropriate for the course.

__✓__ Enable the student to understand the underlying principles of formulas.

__✓__ Enable the student to use and interpret numerical information.

Courses appropriate to the Mathematics Learning Skills Area must be either:

__✓__ A. Mathematics courses that develop signficant mathematical skills required by a major discipline.

_____ B. Mathematics courses designed for Liberal Studies.

      Additional criteria which courses in Category B must meet:

      _____ Develop the student's confidence in handling numerical problems and data.

      _____ Be sensitive to the diverse background characteristics of the student.

      _____ Include elements on the history or appreciation of mathematics.

      _____ Introduce the hand-held calculator or the computer as a tool.